

BALANCE POINT TEMPERATURE CALCULATION (BPT)

1. INDOOR AIR TEMPERATURE, T1 = 68.00

INSTRUCTIONS: Change values in red to your input data. Values in blue are calculated.

2. INTERNAL ENERGY HEAT GAINS, BTUH				
	AREA SQ FT	DENSITY W/SQ FT	HEAT KW	HEAT BTUH
LIGHTS	27,400	1.00	27.40	93,516
EQUIP	27,400	0.50	13.70	46,758
MISC	27,400	0.20	5.48	18,703
SUM				158,978

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3. OCCUPANT INTERNAL HEAT GAIN, BTUH				
AREA SQ FT	OCC PER 1000 SQ FT	TOTAL # OF OCC.	SENSIBLE BTUH/OCC	HEAT BTUH
24900	30	747	314	234,558

4. SOLAR GAIN				
	AREA SQ FT	SHADE % SC	SOLAR BTUH/SF	HEAT BTUH
NORTH	0	0%	0	0
EAST	0	0%	0	0
SOUTH	0	0%	0	0
WEST	0	0%	0	0
SUM	0			0

7. BALANCE POINT TEMPERATURE CALCULATION				
BPT F=T1 - GAINS/(RATE OF LOSS) = F - BTUH/(BTUH/F)				
BPT F=T1 - (INTERNAL + PEOPLE + SOLAR)/(UA + QI)				
BPT F=	46.63	degrees F Outside temperature		

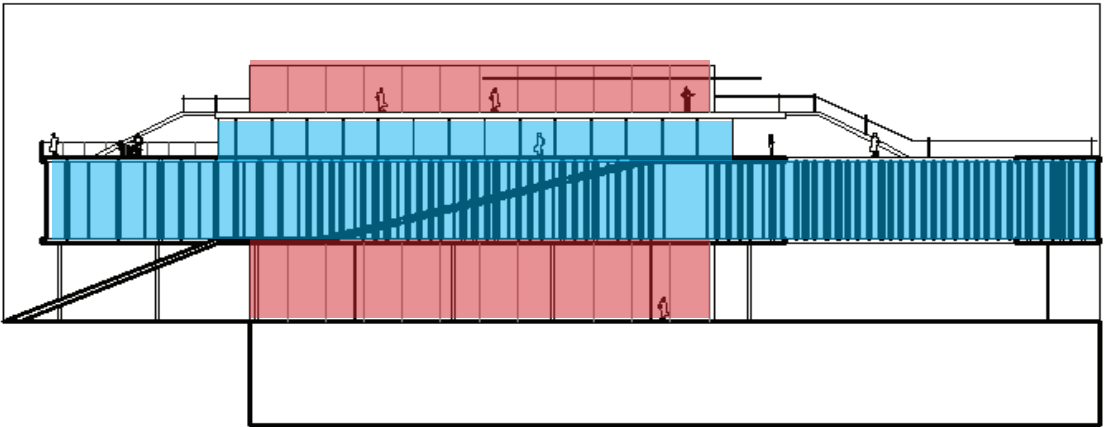
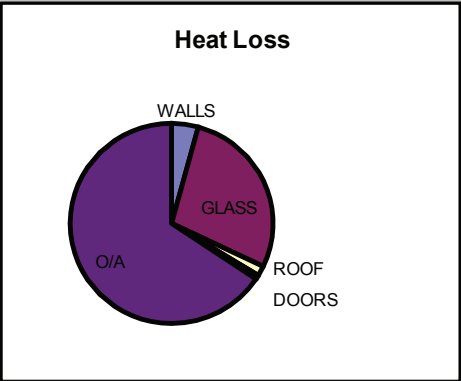
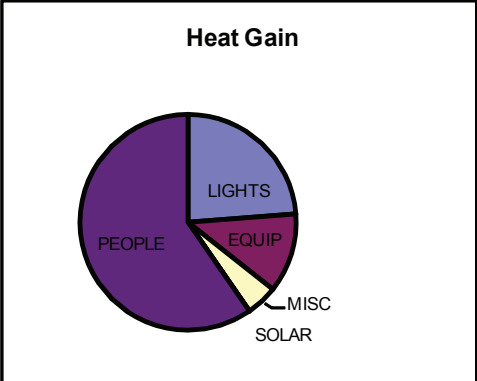
5. RATE OF SKIN LOSSES, BTUH/F			
	AREA SQ FT	R-VALUE INSUL.	UA BTUH/F
WALLS	15764.00	20.00	788.20
GLASS	8160.00	1.60	5100.00
ROOF	9000.00	30.00	300.00
DOORS	200.00	1.60	125.00
SUM	33124.00		6313.20
AVERAGE		5.25	

6. RATE OF O/A LOSSES, BTUH/F			
# OF OCC.	VENT CFM/OCC	ACH CU FT/HR	Qv BTUH/F
747	15	672300	12101

8. HEAT BALANCE			BTUH	TOTAL
GAINS				393536
24%	LIGHTS		93516	
12%	EQUIP		46758	
5%	MISC		18703	
0%	SOLAR		0	
60%	PEOPLE		234558	
LOSSES				393536
4%	WALLS		16844	
28%	GLASS		108991	
2%	ROOF		6411	
1%	DOORS		2671	
66%	O/A		258617	

9. SUMMARY OF FLOW AT BALANCE POINT CONDITION			
Net glass Btuh = solar gain - heat loss			-108991
Net people Btuh = metabolic gain - O/A loss			-24059
See bin data for relationship of balance point temperature to climate. The building will be in the heating mode for all hours the outdoor drybulb is below the BPT. Above the balance point the building is in the cooling mode. If the balance point is below 55 F, free ventilation cooling with 100% O/A may be feasible for dry bulb temperatures between 55 and BPT.			

The project has a total of 27,400 sq. ft of interior spaces, including three theaters, two galleries, and one restaurant. The internal heat gain for these spaces consist of lights at 100watts/100sq. ft, equipment and mechanical at .5watts/ 100sq. ft, and misc (plugs and outlets) at .2watts/100sq ft. The internal energy heat gain of the building comes out to about 158,978BTUH. The internal energy heat gain from light fixtures, equipment, and misc makes up about 40% of the heat gains for the entire building. The other 60% of heat gains is from the high occupant level. The building has about 25,000 sq. ft of occupy able area and using occupancy codes the building turns out to be about 30 occupants for every 1,000sq. ft. The entire interior part of the building holds up to anywhere from 725-750 people, making the total of occupant internal hear gain about 234,558. Solar gain is being ignored in this scenario. As for heat losses the exterior skin is composed of 15,764 sq. ft of walls, 8,160 sq. ft of glass, 9000 sq. ft of, and about 200sq. ft of doors. The total rate of skin losses because of the temperature independent R- Values comes out to be 6313.2 BTUH/F. Using these values and the temperature being at 68 degree F, the balance point temperature (BPT) comes out to be 46.63. When outdoor temperature is below 46.63 the building will need heating, when the outdoor temp is above (or within 5 degrees) 46.63 the building will need cooling.



0' 10' 50' 100' North East Elevation

North East Elevation demonstrating the glass glazing in blue and the walls in red that make up most of the percent of rate of heat loss from the thermal envelope.

